metasurface, and the sensor are two-dimensionally arranged, as seen in a plan view from a direction perpendicular to the first surface.

9. The spectrometer of claim **8**, wherein the transparent substrate comprises a first side surface and a second side surface respectively connecting the first surface and the second surface, and

the collimating metasurface and the grating metasurface are arranged adjacent to the first side surface, and the focusing metasurface and the sensor are arranged adjacent to the second side surface, as seen in the plan view from the direction perpendicular to the first surface.

10. The spectrometer of claim **1**, wherein a height of each of the plurality of nanostructures or a longest dimension of a cross-section of the plurality of nanostructures is less than a wavelength of the light incident onto the transparent substrate.

11. The spectrometer of claim **1**, wherein the spectrum optical system further comprises a grating metasurface,

wherein the grating metasurface comprises a pattern comprising third nanostructures of the plurality of nanostructures, the third nanostructures being arranged apart from each other in a second direction, and

wherein the pattern is cyclically repeated in a first direction that is perpendicular to the second direction.

12. The spectrometer of claim **1**, wherein the focusing metasurface has one or more ring-shaped areas in which diameters of the first nanostructures increase or decrease as a distance of the first nanostructures change from a point on the focusing metasurface.

13. The spectrometer of claim **1**, wherein the spectrum optical system further comprises a split metasurface which is disposed on the second surface and configured to split the light into a first polarization light and a second polarization light based on polarization, and reflect the split first and second polarization lights based on wavelengths, and

the sensor comprises a first sensor configured to receive the split first polarization light and a second sensor configured to receive the split second polarization light.

14. The spectrometer of claim **13**, wherein the focusing metasurface comprises:

a first focusing metasurface which is disposed on the first surface and configured to focus the first polarization light to the first sensor; and

a second focusing metasurface which is disposed on the first surface and configured to focus the second polarization light to the second sensor.

15. The spectrometer of claim **13**, wherein the split metasurface comprises a pattern comprising fourth nanostructures arranged such that a cross-section of each of the fourth nanostructures increases and then decreases in a first direction, and

the pattern is cyclically repeated in the first direction and a second direction that is perpendicular to the first direction.

16. The spectrometer of claim **1**, wherein, when L is a total length of an optical path from the slit to the sensor and D is a thickness of the transparent substrate, L and D satisfy the following inequality:

$$L/D>3.$$

17. The spectrometer of claim **1**, wherein the spectrum optical system further comprises a surrounding structure which surrounds the plurality of nanostructures and comprises at least one among silicon dioxide (SiO_2), a glass, and a polymer.

18. The spectrometer of claim **1**, wherein the transparent substrate comprises at least one among silicon dioxide (SiO_2), a glass, and a polymer.

19. The spectrometer of claim **1**, wherein the plurality of nanostructures comprise at least one among crystalline silicon (c-Si), amorphous silicon (a-Si), poly silicon (p-Si), gallium phosphide (GaP), gallium arsenide (GaAs), silicon carbide (SiC), titanium dioxide (TiO_2), silicon nitride (SiN), and gallium nitride (GaN).

20. A spectrometer comprising:

a substrate comprising a first surface and a second surface disposed opposing one another at different sides of the substrate;

a block layer disposed on the first surface and having a slit for injecting light into the substrate;

a first metasurface including first nanostructures that is disposed on the second surface and configured to receive the light incident through the slit;

a second metasurface including second nanostructures that is configured to receive the light reflected by the first metasurface; and

a sensor which is configured to receive and measure the light reflected from the second metasurface.

21. The spectrometer of claim **20**, wherein the second metasurface is disposed on the first surface,

the first nanostructures are configured to collimate the light incident through the slit and direct the collimated light onto the second metasurface, and

the second nanostructures are configured to focus the collimated light so that the focused light is received by the sensor.

22. The spectrometer of claim **20**, wherein the first nanostructures are configured to split the light in opposite directions, into a first light and a second light, and

the second nanostructures are disposed proximate both edges of the first surface and configured to focus the first light and the second light onto the sensor disposed on the second surface.

23. The spectrometer of claim **20**, further comprising:

a third metasurface comprising third nanostructures and located on an optical path between the first metasurface and the second metasurface.

24. The spectrometer of claim **23**, wherein the third metasurface is disposed on the first surface,

the second metasurface is disposed on the second surface,

the first nanostructures are configured to collimate the light incident through the slit and direct the collimated light onto the third metasurface,

the third nanostructures are configured to disperse the collimated light onto the second metasurface, and

the second nanostructures are configured to focus the dispersed light onto the sensor disposed on the first surface.

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